



Interactions between chemical and climate stressors: A role for mechanistic toxicology in assessing climate change risks

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Abstract:

Incorporation of global climate change (GCC) effects into assessments of chemical risk and injury requires integrated examinations of chemical and nonchemical stressors. Environmental variables altered by GCC (temperature, precipitation, salinity, pH) can influence the toxicokinetics of chemical absorption, distribution, metabolism, and excretion as well as toxicodynamic interactions between chemicals and target molecules. In addition, GCC challenges processes critical for coping with the external environment (water balance, thermoregulation, nutrition, and the immune, endocrine, and neurological systems), leaving organisms sensitive to even slight perturbations by chemicals when pushed to the limits of their physiological tolerance range. In simplest terms, GCC can make organisms more sensitive to chemical stressors, while alternatively, exposure to chemicals can make organisms more sensitive to GCC stressors. One challenge is to identify potential interactions between nonchemical and chemical stressors affecting key physiological processes in an organism. We employed adverse outcome pathways, constructs depicting linkages between mechanism-based molecular initiating events and impacts on individuals or populations, to assess how chemical- and climate-specific variables interact to lead to adverse outcomes. Case examples are presented for prospective scenarios, hypothesizing potential chemical-GCC interactions, and retrospective scenarios, proposing mechanisms for demonstrated chemical-climate interactions in natural populations. Understanding GCC interactions along adverse outcome pathways facilitates extrapolation between species or other levels of organization, development of hypotheses and focal areas for further research, and improved inputs for risk and resource injury assessments.

Source: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3601417>

Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Precipitation, Temperature, Other Exposure

Temperature: Extreme Heat, Fluctuations

Geographic Feature:

resource focuses on specific type of geography

None or Unspecified

Climate Change and Human Health Literature Portal

Geographic Location:

resource focuses on specific location

Global or Unspecified

Health Co-Benefit/Co-Harm (Adaption/Mitigation):

specification of beneficial or harmful impacts to health resulting from efforts to reduce or cope with greenhouse gases

A focus of content

Health Impact:

specification of health effect or disease related to climate change exposure

Morbidity/Mortality

Mitigation/Adaptation:

mitigation or adaptation strategy is a focus of resource

Adaptation

Resource Type:

format or standard characteristic of resource

Research Article

Resilience:

capacity of an individual, community, or institution to dynamically and effectively respond or adapt to shifting climate impact circumstances while continuing to function

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Timescale:

time period studied

Time Scale Unspecified

Vulnerability/Impact Assessment:

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content